# CLAIMS

1. A microelectronics package, comprising:

a chip having an electronic circuit and

a first converter coupled to the circuit to receive an electronic signal from the circuit, the first converter operable to convert the electric signal into a corresponding electromagnetic signal; and

a chip package including

a second converter positioned on the chip package to receive the electromagnetic signal from the first converter and operable to convert the received electromagnetic signal into a corresponding electric signal.

2. The microelectronics package of claim 1 wherein:

the second converter is disposed on the first side of the chip package;

the first converter is disposed on the second side of the chip;

and further comprising an intermediate layer disposed between the first side of the chip package and the second side of the chip.

3. The microelectronics package of claim 1 wherein:

the intermediate layer comprises an adhesive layer having an index of refraction allowing a signal emitted from the first converter and the second converter to be transferred therethrough.

4. The microelectronics package of claim 2 wherein the electromagnetic signals comprise laser emissions.

5. The microelectronics package of claim 2 wherein the electromagnetic signals comprise optical signals.

6. The microelectronics package of claim 2 further comprising an encapsulation layer enveloping the first surface of the chip package and the chip.

7. The microelectronics package of claim 1 wherein the second side of the chip is disposed on the first side of the chip package;

the first converter being disposed on the first side of the chip; and

the second converter being disposed on the first side of the chip package.

8. The microelectronics package of claim 6 wherein the electromagnetic signals comprise infrared signals; and the chip comprises silicon.

9. The microelectronics package of claim 7 further comprising an encapsulation layer enveloping the first surface of the chip package and the entire chip.

10. A chip, comprising:

a circuit formed on the chip; and

a converter formed on the chip and coupled to the circuit to receive electric signals from the circuit,

the converter being adapted to convert the electric signals from the circuit into corresponding electromagnetic signals,

the converter also being adapted to receive electromagnetic signals and convert the electromagnetic signals into corresponding electric signals that are applied to the circuit.

11. The chip of claim 10 wherein:

the converter is disposed on the second side of the chip body, the converter being oriented to transmit electromagnetic signals away from the chip body.

12. The chip of claim 11 wherein the electromagnetic signal comprises laser emissions.

13. The microelectronics package of claim 11 wherein the electromagnetic signal emitted by the converter comprises an optical signal.

14. The chip of claim 11 further comprising an encapsulation layer enveloping the chip.

15. The chip of claim 10 wherein the converter is disposed on the first side of the chip body, the converter being adapted to transmit the electromagnetic signal through the chip body toward the second side of the chip body.

16. The chip of claim 15 wherein:
the electromagnetic signal comprises an infrared signal; and
the chip comprises silicon

17. The microelectronics package of claim 15 further comprising an encapsulation layer enveloping the chip.

18. The chip of claim 10, wherein
the chip includes a memory circuit formed in the chip, the memory circuit being adapted to receive electronic address, data and control signals and transfer data to and from storage elements in response to the electronic signals.

19. A method of transferring data between a chip and a chip package, the chip including memory circuitry having control, address, and data signals, the chip further having bond pads coupled to the memory circuitry to transfer control, address, and data signals to and

from the circuitry, the chip package including a plurality of conductive components, the method comprising:

receiving an electronic signal from a bonding pad;

converting the electronic signal to an electromagnetic signal;

transmitting the electromagnetic signal;

receiving the electromagnetic signal;

converting the received electromagnetic signal to an electronic signal; and

applying the electronic signal to a conductive component of the chip package.

20. The method according to claim 19 wherein the operation of transmitting the electromagnetic signal comprises transmitting the electromagnetic signal through an intermediate layer away from chip without the transmission propagating first through the chip.

21. The method of claim 20 wherein the operation of transmitting the electromagnetic signal through an intermediate layer comprises transmitting the electromagnetic signal through an adhesive layer having an index of refraction allowing the electromagnetic signal to pass therethrough.

22. The method according to claim 20 wherein the operation of transmitting an electromagnetic signal comprises emitting a laser signal.

23. The method according to claim 20 wherein the operation of transmitting an electromagnetic signal comprises emitting an optical signal.

24. The method according to claim 20 further comprising encapsulating the first surface of the chip package, the chip, and the intermediate layer with an encapsulating layer.

25. The method according to claim 19 wherein the operation of transmitting the electromagnetic signal comprises transmitting the electromagnetic signal through the chip itself.

26. The method according to claim 25 further comprising coupling the chip to the chip package, wherein the chip comprises a silicon chip;

and further wherein the operation of transmitting an electromagnetic signal comprises emitting an infrared signal.

27. The method of claim 25 further comprising encapsulating at least a portion of the chip package and the entire chip with an encapsulating layer.

28. A method of transferring data between a chip and a chip package, the chip including memory circuitry having control, address, and data signals, the chip further having bond pads coupled to the memory circuitry to transfer control, address, and data signals to and from the circuitry, the chip package including a plurality of conductive components, the method comprising:

receiving an electronic signal from a conductive component;

converting the electronic signal to an electromagnetic signal;

transmitting the electromagnetic signal;

receiving the electromagnetic signal;

converting the received electromagnetic signal to an electronic signal; and

applying the electronic signal to a bonding pad of the chip.

29. The method according to claim 28 wherein the operation of transmitting the electromagnetic signal comprises transmitting the electromagnetic signal through an intermediate layer away from chip without the transmission propagating first through the chip.

30. The method of claim 29 wherein the operation of transmitting the electromagnetic signal through an intermediate layer comprises transmitting the electromagnetic signal through an adhesive layer having an index of refraction allowing the electromagnetic signal to pass therethrough.

31. The method according to claim 29 wherein the operation of transmitting an electromagnetic signal comprises emitting a laser signal.

32. The method according to claim 29 wherein the operation of transmitting an electromagnetic signal comprises emitting an optical signal.

33. The method according to claim 29 further comprising encapsulating the first surface of the chip package, the chip, and the intermediate layer with an encapsulating layer.

34. The method according to claim 28 wherein the operation of transmitting the electromagnetic signal comprises transmitting the electromagnetic signal through the chip itself.

35. The method according to claim 34 further comprising coupling the chip to the chip package, wherein the chip comprises a silicon chip;

and further wherein the operation of transmitting an electromagnetic signal comprises emitting an infrared signal.

36. The method of claim 34 further comprising encapsulating at least a portion of the chip package and the entire chip with an encapsulating layer.

37. A microelectronics package, comprising:

a chip including an electronic circuit that provides and receives electronic signals, the chip including a first converter coupled to the electronic circuit and operable to receive an electric signal from the electronic circuit and convert the electric signal into a corresponding output electromagnetic wave, and/or operable to receive an input electromagnetic wave and convert the input electromagnetic wave into a corresponding electric signal that is applied to the electric circuit; and

a chip package physically coupled to the chip, the chip package including a second converter that is operable to receive the output electromagnetic wave from the first converter and convert the received output electromagnetic wave into a corresponding output electric signal, and/or operable to receive an input electric signal applied to the chip package and to convert the input electric signal into the input electromagnetic wave and communicate the input electromagnetic wave to the first converter.

38. The microelectronics package of claim 37 wherein the electronic circuit comprises a memory circuit that generates data signals in response to control and address signals, and the second converter on the chip package receives electric address and control signals and converts those signals into corresponding control and address electromagnetic waves that are communicated to the first converter which, in turn, converts the control and address electromagnetic waves into corresponding electric control and address signals that are applied to the memory circuit.

39. The microelectronics package of claim 37 wherein the electronic circuit comprises a memory circuit that provides data signals in response to control and address signals, and the second converter on the chip package receives electric data signals and converts those signals into corresponding data electromagnetic waves that are communicated to the first

converter which, in turn, converts the data electromagnetic waves into corresponding electric data signals that are applied to the memory circuit, and the first converter receives electric data signals from the memory circuit and converts those signals into corresponding data electromagnetic waves that are communicated to the first converter which, in turn, converts the data electromagnetic waves into corresponding electric data signals that are applied to the memory circuit.

40. The microelectronics package of claim 37 wherein the first and second converters comprise optical converters and the input and output electromagnetic waves comprise optical waves.

41. The microelectronics package of claim 37 wherein the first and second converters comprise infrared converters and the input and output electromagnetic waves comprise infrared waves.

42. The microelectronics package of claim 37 wherein the first and second converters comprise a plurality of first and second converter pairs, each pair operating in combination to communicate a single electric signal between the chip package and the electronic circuit.

43. The microelectronics package of claim 37 wherein the chip includes a first side and the first converter is formed on the first side, and the chip package includes a first side on which the second converter is positioned, the chip being physically coupled to the chip package with the first side of the chip positioned adjacent the first side of the chip package.

44. The microelectronics package of claim 37 wherein the chip includes a first side and a second side opposing the first side, the first converter being formed on the first side, and the chip package including a first side on which the second converter is positioned, the chip

being physically coupled to the chip package with the second side of the chip positioned adjacent the first side of the chip package.

45. A memory device, comprising:

a chip including memory circuitry, the memory circuitry including,

an address decoder coupled to an address bus;

a read/write circuit coupled to a data bus;

a control circuit coupled to a control bus;

a memory-cell array coupled to the address decoder, control circuit, and read/write circuit; and

a first converter coupled to the address, data, and control busses, the first converter operable to data signals on the data bus and convert the data signals into corresponding data output electromagnetic waves, and operable to receive address, data, and control electromagnetic waves and convert these electromagnetic waves into corresponding electric address, data, and control signals that are applied on the address, data, and control busses, respectively; and

a chip package physically coupled to the chip and including a plurality of conductors, the chip package including a second converter that is operable to receive the data output electromagnetic waves from the first converter and convert these received electromagnetic waves into corresponding electric data output signals that are applied to corresponding conductors, and the second converter operable to receive electric address, data, and control signals on corresponding conductors and to convert these electric signals into corresponding address, data, and control electromagnetic waves that are communicated to the first converter.

46. The memory device of claim 45 wherein the electromagnetic waves comprise optical electromagnetic signals.

47. The memory device of claim 45 wherein the electromagnetic waves comprise infrared electromagnetic waves.

48. The memory device of claim 45 wherein the first and second converters comprise laser diodes.

49. The memory device of claim 45 wherein the memory device comprises a dynamic random access memory.

50. A computer system, comprising:

a data input device;

a data output device;

a processor coupled to the data input and output devices; and

a memory device including a chip package having a plurality of conductors coupled to the processor, the memory device including,

a chip including memory circuitry, the memory circuitry including,

an address decoder coupled to an address bus;

a read/write circuit coupled to a data bus;

a control circuit coupled to a control bus;

a memory-cell array coupled to the address decoder, control circuit, and read/write circuit, the memory-cell array; and

a first converter coupled to the address, data, and control busses, the first converter operable to data signals on the data bus and convert the data signals into corresponding data output electromagnetic waves, and operable to receive address, data, and control electromagnetic waves and convert these electromagnetic waves into corresponding electric address, data, and control signals that are applied on the address, data, and control busses, respectively; and

a chip package physically coupled to the chip, the chip package including a second converter that is operable to receive the data output electromagnetic waves from the first converter and convert these received electromagnetic waves into corresponding electric data output signals that are applied to corresponding conductors, and the second converter operable to receive electric address, data, and control signals on corresponding conductors and to convert these electric signals into corresponding address, data, and control electromagnetic waves that are communicated to the first converter.

51. The computer system of claim 50 wherein the electromagnetic waves comprise optical electromagnetic signals.

52. The computer system of claim 50 wherein the electromagnetic waves comprise infrared electromagnetic waves.

53. The computer system of claim 50 wherein the first and second converters comprise laser diodes.

54. The computer system of claim 50 wherein the memory device comprises a dynamic random access memory.